

# INSTREAM PROJECT DESIGN CHECKLIST

*For Design and Construction of Flood and Erosion Protection Facilities and Habitat Restoration Projects that May Include Large Wood Placement or Natural Wood Recruitment*

Project Name: Teufel PL84-99 Mitigation (large wood component) Project Manager: Jennifer Rice

River/River Mile/Bank: Green River / RM 20.35 Left Bank Date 9-29-16

Check one or both:

Project includes placement of large wood elements

Project may influence the recruitment, mobility and accumulation of natural large wood.

**Note:** If the project is comprised of emergency work, then fill out and file this form within 30 days of completion of emergency work.

## **I. Project Background and Preliminary Design (30-40 Percent) Information**

*(Provide general information at a conceptual level)*

1. Describe the overall river management context, strategy and objectives for the river reach. Refer to pertinent plans, policies or documents pertaining to flood hazards, salmon recovery, etc.

The Teufel Nursery property is located on the left bank of the Lower Green River, between River Mile (RM) 20 and 20.8. It has no levees. This site was identified as a proposed project location in both the King County Flood Hazard Management Plan (2006) and the Green/Duwamish and Central Puget Sound Watershed Salmon Habitat Plan (WRIA 9) (2005). The project area is referred to as the Rosso Nursery in both plans. The King County Flood Control District purchased the Teufel site in 2011 after it was determined to provide ample room (over 36 acres) for current mitigation needs as well as for future flood risk reduction and salmon habitat restoration work.

In 2008 and 2009, King County on behalf of the King County Flood Control District removed 461 trees from levees along the Lower Green River. The objective of removing the trees from the levees was to meet Army Corps of Engineers Levee Rehabilitation and Inspection Program vegetation management compliance standards that were in place at the time. State environmental permits were required to allow the tree removal work, and one of the permit conditions was to mitigate for the tree removal by planting four trees for every tree removed and installing one piece of large wood for every tree that was removed from the riverward face of a levee. 1,844 planted trees and 146 pieces of placed wood were ultimately required for mitigation. Several small mitigation sites were identified, but a need remained for a large site to plant the remaining 1,046 trees and place 85 pieces of large wood. The Teufel site was chosen because it has no levees, and since much of the lower river is leveed, there are very few available sites where a large wood project and mitigation plantings would not conflict with Corps standards.

2. Describe the goals and objectives of the project and its relative importance to the success of DNRP program goals and mandates. Identify funding source(s) and describe any applicable requirements or constraints.

Tree cutting on levees along the Green River in 2008 and 2009 to remain in compliance with US Army Corps of Engineers levee vegetation policies, required an Hydraulic Project Approval (HPA) permit from the Washington Department of Fish and Wildlife (WDFW). The HPA required mitigation for the loss of riverside trees. The proposed Teufel project will fulfill the remaining HPA mitigation requirements by planting 1,046 trees within 150 feet of ordinary high water along the Green River to mitigate for trees cut on the PL-84-99 levees (a 4-1 ratio), and by placing 85 logs in in the river to mitigate for trees cut on the riverward side of the PL84-99 levees (a 1-1 ratio). The King County Flood Control District is funding this mitigation project.

Stated project goals are as follows:

- The Project will complete and fulfill all outstanding mitigation requirements established as a condition of the HPA issued by WDFW for tree cutting along the riverbank at other levee locations in 2008 and 2009;
- The required 85 logs will be securely anchored within the channel margins at the inside of the meander bend in a manner that minimizes exposure to potential recreational users of the river channel;
- The required 1,046 native trees will be planted within 150 feet of the river.

Additional objectives and constraints are as follows:

- The large wood project must place at least 85 pieces of large wood with rootwads in the Green River, and be approved by the WDFW as adequate mitigation for the issuance of the earlier HPA for tree cutting. Logs will have a minimum 24-inch basal diameter, be at least 25 feet long, and have attached rootwads;
  - The project must be designed to ensure stability and retention of all components during the design flood flow (100 year flood);
  - The large wood component of the project will be designed to maximize rearing and refuge habitat for juvenile salmonids during the January to June rearing and outmigration period;
  - The riparian planting will be designed to maximize shade to the river along the northern boundary of the project site, which has been identified in the Muckleshoot Indian Tribe sun aspect study as having critical and high shade priority;
  - The project must be in compliance with all federal, state, and city permit requirements, including bald eagle and fish construction windows;
  - The project design process will follow King County procedures for considering public safety when placing large wood in King County rivers;
  - Structures will be designed and placed in a manner that has boater and floater safety as a priority.
  - The structure will be designed in a manner that reduces the occurrence of sedimentation for the life of the structure and doesn't increase flood risks to neighboring properties.
3. Describe the existing (and historic, if relevant) site and reach conditions, including structural features, channel form, and the presence of naturally-deposited large wood. Describe known utilization by salmonids and any important or unique biological or ecological attributes.

Salmon habitat in the Lower Green River is degraded compared with historical conditions as a result of land use changes, floodplain development, and river management activities such as channel confinement by levees and revetments, flood control at Howard Hansen Dam, and diversion of the White River. The highly engineered Lower Green River that resulted from these actions is characterized by confined, armored channels that lack the in-stream geomorphic complexity and floodplain connection needed to create aquatic habitats that support healthy fish populations, including ESA-listed species such as Puget Sound Chinook salmon, steelhead, and bull trout. The Lower Green River main stem channel is physically isolated from its floodplain by a series of levees and revetments, and hydrologically isolated from the floodplain by both river bed incision and greatly reduced flood elevations. Shoreline and riparian areas lack mature trees, resulting in minimal shade and elevated water temperatures. Existing water temperatures and dissolved oxygen do not meet water quality standards, leading to adverse, sometimes lethal, effects on threatened species; the river is on the Clean Water Act Section 303 (d) list and has a total maximum daily load (TMDL) for water temperature. The lack of riparian trees and shrubs also reduces available food resources for juvenile salmonids.

The river channel through the project reach is confined by levees and revetments along the right bank and the Teufel property is one of the few remaining sections of the left bank of the Green River in this reach to be unarmored. The wood installation site is located on the inside of a meander bend so flow velocities are slow and sediment (mostly sand) tends to be deposited. A large lateral scour pool formed by scour against riprap along the right bank was identified by Anchor QEA (2003). The Muckleshoot Indian Tribe bathymetric survey also identified a pool along the outside bend of the right bank, as well as a sand bench along the inside bend of the left bank (2014), in the vicinity of the proposed wood installation. An accumulation of small wood is currently present in a small portion of the wood installation site. Seven species of salmonids use the river in the project reach: Chinook, chum, pink, and coho salmon, and steelhead (rainbow), cutthroat, and bull trout.

The Teufel property used to be a commercial landscape nursery so vegetation throughout the site is disturbed. Few large trees are present, although many cottonwood saplings have colonized the site. Grass and weedy forbs dominate most of the interior of the property; the riverbank within the wood addition site is dominated by dense Himalayan blackberry. A small stand of two or three mature cottonwoods is located at the upstream end of the wood addition area; these trees provide shade to the river and an active bald eagle nest is located in one of them.

4. Describe what is known about adjacent land uses and the type, frequency, and seasonality of recreational uses in the project area. Are there nearby trail corridors, schools or parks? What is the source(s) of your information?

The regional Green River Trail is located across the river from the project area. While not a formal trail, Frager Road, along the landward (west) side of the Teufel property is used often by cyclists, runners and walkers. The Riverbend Golf Complex is located across the Green River to the south of the project area between River Miles 20.4 and 21.8.

In-river recreational use of the Lower Green River is low based on the King County [Synthesis of 2013 River Recreation Studies](http://www.kingcounty.gov/depts/dnrp/wlr/sections-programs/river-floodplain-section/documents/2013-recreation-study.aspx) (p. 32). The full report is available at <http://www.kingcounty.gov/depts/dnrp/wlr/sections-programs/river-floodplain-section/documents/2013-recreation-study.aspx>. Although recreational use of the Green River along the project reach was not observed directly in this report, the studied reach between Russell Woods Park (RM 19.4) and Briscoe Park (RM 15.9) is less than one mile downstream of the Teufel property and, since there are no known put-in or take-out points between the two locations, observations in this reach are expected to be similar to recreational use in the project area. The King County study found that the Lower Green River reach had much lower numbers of people per day than areas up-river, the highest life vest usage, and the highest use of boats with paddles (canoes and kayaks) rather than rafts and inner tubes. For example, remote cameras placed between Russell Woods Park and Briscoe Park recorded a total of 167 uses of the project reach in 2013 (0.5 people per day), 94% of people observed were adults, 70.7% of the people were observed with life vests, and 85% of the vessels counted were canoes or kayaks with paddles.

5. If the project includes wood placement, describe the conceptual design of large wood elements of the project, including, if known at this stage in the design, the amount, size, location, orientation, elevation, anchoring techniques, and type of interaction with the river and stream at a range of flows.

The in-stream wood structure will consist of 85 pieces of wood that are at least 25 feet long and 24 inches basal diameter, with attached rootwads. The structure will be located along approximately 280 feet of an inside bend at the Teufel property, will vary in height between three and five log layers, and will be secured with piles and chains. The log structure will stand about eight vertical feet from the river bed at its highest point, and provide habitat over the range of flows between 2,800 cfs (cubic feet per second) and 400 cfs, to provide important slow water habitat for juvenile salmon during the key January- June rearing and outmigration period for Chinook salmon. River recreational safety has been optimized by placing deflector logs at the upstream end of the wood structure, and by designing the structure so that less than one foot of it will be in the water during low summer flows (July-September) when the river is likely to receive recreational use.

6. If the project includes wood placement, what is the intended structural, ecological or hydraulic function of the placed wood? What role does the placed wood have in meeting the project's goals and objectives? Is the project intended to recruit or trap additional large wood that may be floating in the river?

The purpose of the placed wood is to create and enhance rearing and refuge habitat for juvenile salmon over a wide range of flows, and provide immediate shade and thermal refuge for fish. The project is not designed to intentionally trap additional wood floating in the river, but it may do so.

7. Is the project likely to affect the recruitment, mobility or accumulation of natural large wood, e.g., by encouraging wood deposition on or near the site or promoting bank erosion that may cause tree toppling? Describe expected site evolution and its potential effects on natural wood dynamics.

There is very little natural large wood in this reach of the Green River so the project is not anticipated to have much effect on wood recruitment or mobility. The 1,043 trees that will be planted in the riparian corridor (within 150 feet of the river) to restore riparian functions are expected to contribute to natural recruitment to the river in the long-term: 20+ years after project construction. Planted trees are not expected to contribute to any wood that might rack-up on the installed wood structure because the tree planting mitigation area is downstream of the large wood installation site.

8. Describe how public safety considerations have been incorporated into the preliminary project design. For placed wood, address each of the considerations:
  - a. *Type, frequency, and seasonality of recreational use*; As stated above, use of this reach of the river is low based on King County's Synthesis of 2013 River Recreation Studies (0.5 people per day). Compared to the other two reaches of the

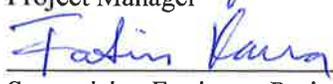
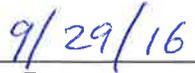
Green River studied (upstream at Whitney Bridge at RM 41.3, and Auburn-Black Diamond to Isaac Evans Park from RM 29.1-33.4), the Lower Green River through the project site had much lower numbers of people per day, the highest life vest usage, and the highest use of boats with paddles rather than rafts and inner tubes.

- b. *Wood location, positioning, and anchoring techniques:* The large wood structure is located along an inside bend of the Green River, away from the main river current, and has deflector logs at the upstream end to direct any recreational users away from installed wood, so the wood is not expected to contact recreational river users even during high flows. Logs with rootwads will be chained to wood piles driven to depth as needed to maintain project stability up to, and including, a 100 year flood event. Logs will be attached to the piles and to each other with chains to maintain stability. Less than one foot of the wood structure will be in contact with the water during low summer flows, which average between 529 and 349 cfs from July through September.
  - c. *Maximizing achievement of project goals and objectives while minimizing potential public safety risks:* The wood structure is designed to be in the water during the January to June rearing and outmigration period for juvenile Chinook salmon. Since most inexpert floating and boating occurs during summer low-flow times (July-September), when less than one foot of the wood structure is anticipated to be wetted, we can meet both habitat and public safety goals as part of this project. The additional inclusion of bumper logs at the upstream end for river recreation safety will help minimize unintentional interaction with the structure in periods of higher flow.
  - d. *Use of established and recognized engineering, geological, and ecological expertise:* The project team includes two experienced King County Engineers, an experienced King County Ecologist, a Supervising Engineer, and a Project Manager and Coordinator. Project design support is provided by Cardno Consulting Firm, with Jack Bjork, a licensed PE, as the lead design engineer. The Cardno design team also includes Jonathan Ambrose, a Water Resources Scientist with hydraulic analysis, geomorphic assessment, design, and permitting experience. Associated Earth Sciences is providing geotechnical engineering, and Northwest Hydraulic Consultants, with significant experience modeling the Green River system, is performing the hydraulic modeling for this project. The design of this project is consistent with the best professional practices and standard of care.
9. Has the project been reviewed and approved by a Licensed Professional Civil Engineer? Please list other licensed technical staff who have reviewed and provided input on the design (e.g., Licensed Geologist and Licensed Engineering Geologist). Specify the Engineer of Record for the design and any other Licensed Professionals who have sealed their portion of the design plans. Were all reviews and approvals completed?

The project is still in design, but as it is being developed it is being reviewed and approved by multiple licensed civil engineers (PEs), within their areas of practice. Jack Bjork, a licensed PE, is the lead design engineer and will stamp the 100% design plans, and Matt Miller is the geotechnical engineer providing earthwork and pile specifications. The King County project team includes certified professional engineers Joe O'Leary and Fatin Kara. In addition, the project team is being assisted by Will Mansfield, a PE with significant large wood placement experience, and Erik Peters, a PE with experience designing large flood control/habitat projects on the Green River. A series of reviews and approvals will occur until 100% design is complete and drawings are signed by Jack Bjork, before construction bidding.

10. Has the project been reviewed and approved by a King County Professional Ecologist (e.g., person with an advanced degree in aquatic and/or biological sciences from an accredited university or equivalent level of experience) if ecological benefits are an intended project objective, to evaluate the consistency of the design with project goals, existing environmental policies and regulations, and expected or known permit conditions? Specify the Reviewing Ecologist for the project. Was this review and approval completed? What is the anticipated schedule for completing project milestones (30-40% design, final design, major construction/earthmoving) and for soliciting public input)?

Yes the County's project ecologist Kerry Bauman has reviewed and approved the preliminary design. Final design is anticipated to be completed by November 2016 with construction in August 2017 after public process and permitting is completed.

	
Project Manager	Supervising Engineer, Project Supervisor or Unit Manager
	
Date	Date

**II. Pre-Construction Information** (70% or 100% design with permits) *These questions relate to the designed and permitted project. Information should include input resulting from permit review process, SEPA, boater safety meetings and any other stakeholders.*

11. Have any answers provided in Section I at the Preliminary Design Phase changed in the interim? If so, provide the new answers and the rationale for the change.
12. What regulatory review or permits are required for the project (e.g. HPA, Clearing and Grading permit, COE permits)? List any conditions or requirements included in the permit approvals relevant to placement of large wood in the project.
13. What specific actions or project elements were employed to address public safety in the final, permit-approved design?
14. Describe how the project team solicited public input on the preliminary design. Describe the input received from the public and how, if appropriate, the project team has responded to this input.
15. Describe any additional design modifications or mitigating actions that were or will be taken in response to the public comments.
16. Will further educational or informational materials be made available to the public to heighten awareness of the project (e.g., public meeting, press release, informational website, or temporary or permanent signage posted in the vicinity of the project)? If so, explain.
17. If the project is expected to influence the recruitment, mobility or accumulation of natural wood, has a Public Safety Management Plan been completed?

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Project Manager

Date

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Supervising Engineer, Project Supervisor or Unit Manager

Date

**III. Post-Construction Actions or Project Modifications**

18. Have any answers provided in Sections I and II at the Preliminary design and Pre-Construction phases changed in the interim? If so, provide the new answers and the rationale for the change.

19. Briefly describe the scope and timing of post-construction monitoring and inspection activities planned for the project as they relate to large wood. If a Public Safety Management Plan or Monitoring Plan has been developed for the project, you may simply reference and attach that document.

20. If post construction monitoring or inspections result in modifications to the project, please describe the action taken and the rationale and consistency with the Public Safety Management Plan, if applicable.

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Project Manager

Date

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Supervising Engineer, Project Supervisor or Unit Manager

Date